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Impact vibrations of ultrasonic multistriker hand tool

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Abstract

© Springer International Publishing Switzerland 2015. The impact vibrations of the multi-striker ultrasonic hand tool are investigated theoretically and experimentally. The lightweight intermediate strikers are placed into the gap between the end-face of the high-power ultrasonic converter and the specimen being treated. The high-frequency impact force was measured by the calibrated piezoelectric sensor. The dynamical drift of the tool casing was measured by the linear displacement gauge. Both signals were simultaneously recorded with the use of the two-channel digital storage oscilloscope. The scanpictures allow to determine the duration of the single impact pulse and its peak value, frequency of the pulse sequence, etc. It was observed, that slow oscillations of the tool casing are synchronously accompanied by the periodical changes of impact force. The dynamic model of the high-frequency impact treatment was constructed by the methods of theory of the vibro-impact systems. The induced impact stresses were calculated in the frames of the Hertz contact approximation with the use of experimental data. It is shown that the impact stress value reaches the yield point of material being treated. The ultrasonic impact processing can be interpreted as a cyclic alternation of setting-up and failure of the vibro-impact oscillation of the striker inside the variable gap. The changes in the mechanical properties and texture were analyzed by the metallographic methods. Metal hardening and creation of the profitable residual stresses on the surface of the specimen were observed.

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Keywords

Residual stresses, Ultrasonics, Vibro-impact system